

# MATERNAL HEALTH PRACTICES AND CHILD DEVELOPMENT PROJECT

ALCOHOL USE DURING  
PREGNANCY: A  
LONGITUDINAL STUDY N.  
DAY

AN EPIDEMIOLOGICAL  
STUDY OF PRENATAL  
MARIJUANA EXPOSURE  
N. DAY

PRENATAL ALCOHOL  
EXPOSURE: COGNITIVE  
AND BRAIN FUNCTION  
J. WILLFORD

ALCOHOL  
RESEARCH  
TRAINING  
PROGRAM

PSYCHIATRIC  
EPIDEMIOLOGY  
TRAINING  
PROGRAM

TEENAGE PRENATAL  
TOBACCO/MARIJUANA USE:  
FOLLOW-UP STUDY  
M. CORNELIUS

DATA  
INSTRUMENTS  
ADMINISTRATION  
PERSONNEL  
ANALYSIS

PRENATAL COCAINE  
USE: A LONGITUDINAL  
EPIDEMIOLOGIC STUDY  
G. RICHARDSON

TOBACCO: PRENATAL  
EFFECTS AND  
ADOLESCENT USE  
N. DAY, M. CORNELIUS

CHILDHOOD ABUSE,  
ALCOHOL USE, AND PTSD  
C. LARKBY

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# STUDY DESIGN

- 21 YEARS
- 16 YEARS
- 14 YEARS
- 10 YEARS
- 6 YEARS
- 3 YEARS
- 18 MONTHS
- 8 MONTHS
- DELIVERY
- 7TH PRENATAL MONTH
- 4TH PRENATAL MONTH 1982-1985

# Study Follow-Up Rates

	Birth	8 Month	18 Month	3 Year	6 Year	10 Year	14 Year
Inter- viewed	595	465	509	526	522	490	460
Rate	96%	81%	91%	95%	94%	90%	84%

# **DOMAINS OF DATA: MATERNAL**

## **DEMOGRAPHIC FACTORS**

**RACE**

**AGE**

**MARITAL STATUS**

**EDUCATION**

## **MEDICAL FACTORS**

**PREGNANCY AND LABOR**

**CURRENT HEALTH  
STATUS**

**MEDICATIONS**

## **PSYCHOLOGICAL FACTORS**

**DEPRESSION**

**ANXIETY**

**HOSTILITY**

**SELF-ESTEEM**

**DIAGNOSTIC INTERVIEW  
SCHEDULE**

**HISTORY OF CHILDHOOD  
ABUSE**

# MATERNAL FACTORS

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## SOCIAL FACTORS

DYADIC ADJUSTMENT

SOCIAL SUPPORT

LIFE EVENTS

RELIGION

NEIGHBORHOOD

EXPOSURE TO VIOLENCE

## ENVIRONMENTAL FACTORS

FAMILY ENVIRONMENT

HOUSEHOLD  
STRUCTURE

PARENTAL WARMTH

SUPERVISION

DISCIPLINE

# MATERNAL FACTORS

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## **COGNITIVE MEASURES**

**MATERNAL IQ**

## **PARENTING PRACTICES**

**WARMTH**

**SUPERVISION**

**DISCIPLINE**

# **PARENTAL SUBSTANCE USE**

## **PRENATAL DRUG AND ALCOHOL USE**

**MARIJUANA, TOBACCO, OTHER ILLICIT DRUGS, ALCOHOL  
EACH TRIMESTER AND EACH MONTH OF THE FIRST  
TRIMESTER**

## **POSTNATAL DRUG AND ALCOHOL USE**

**DRUG AND ALCOHOL USE OF THE FATHER AND THE MALE  
IN THE HOUSEHOLD**

**HISTORY OF USE AND ABUSE**

**CURRENT USE**

**DIAGNOSIS OF SUBSTANCE USE DISORDERS (DSM-IV)**



# Prevalence of Alcohol Use During Pregnancy

**12.5% OF WOMEN DRINK DURING PREGNANCY**

**3% DRANK AT LEAST 7 DAYS / WEEK**

**3.4% OF WOMEN BINGE DURING PREGNANCY**

**DRINKING RATES HAVE NOT CHANGED SINCE 1991.**

(Floyd & Sidhu, 2004)

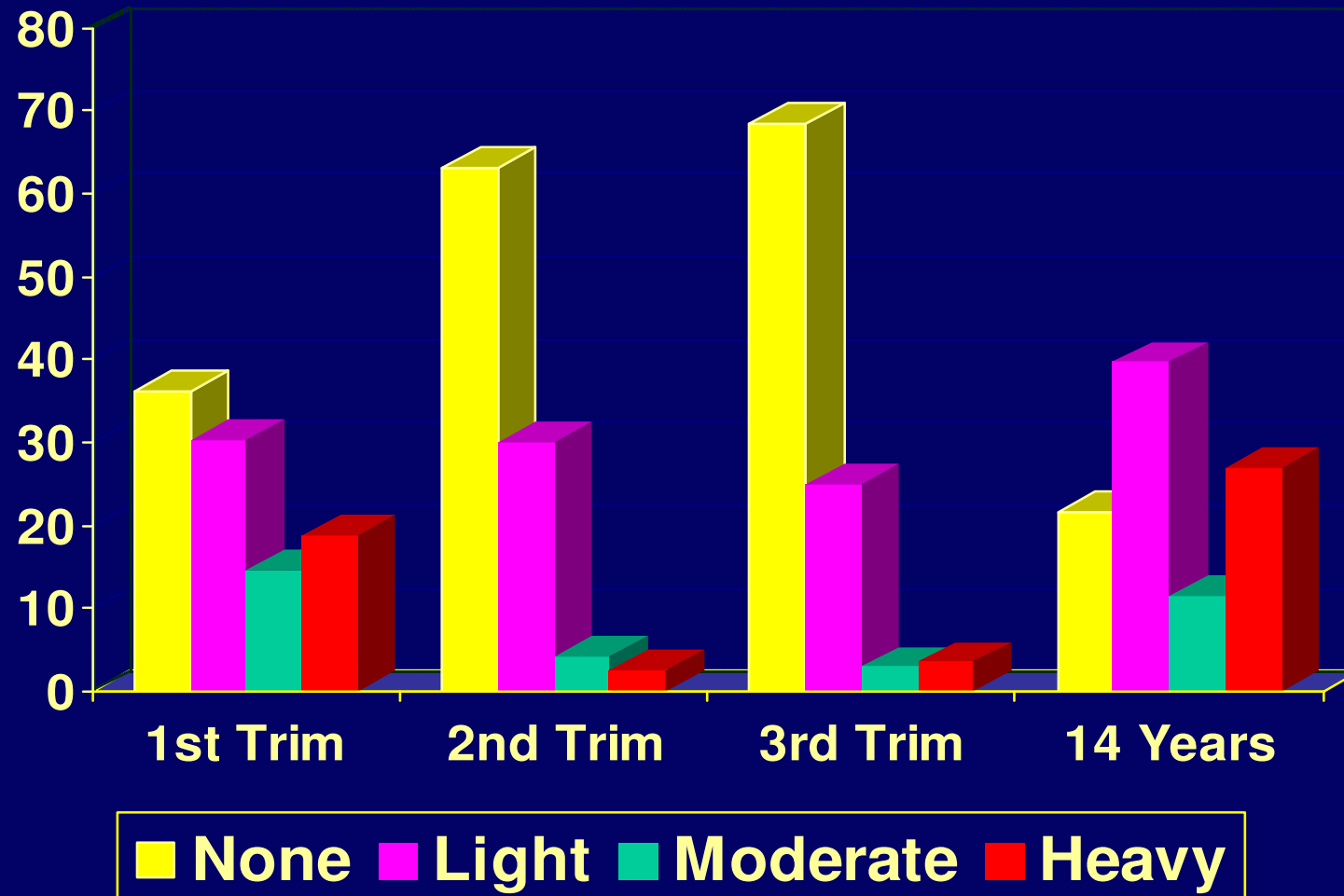
# **RISK FACTORS FOR DRINKING DURING PREGNANCY**

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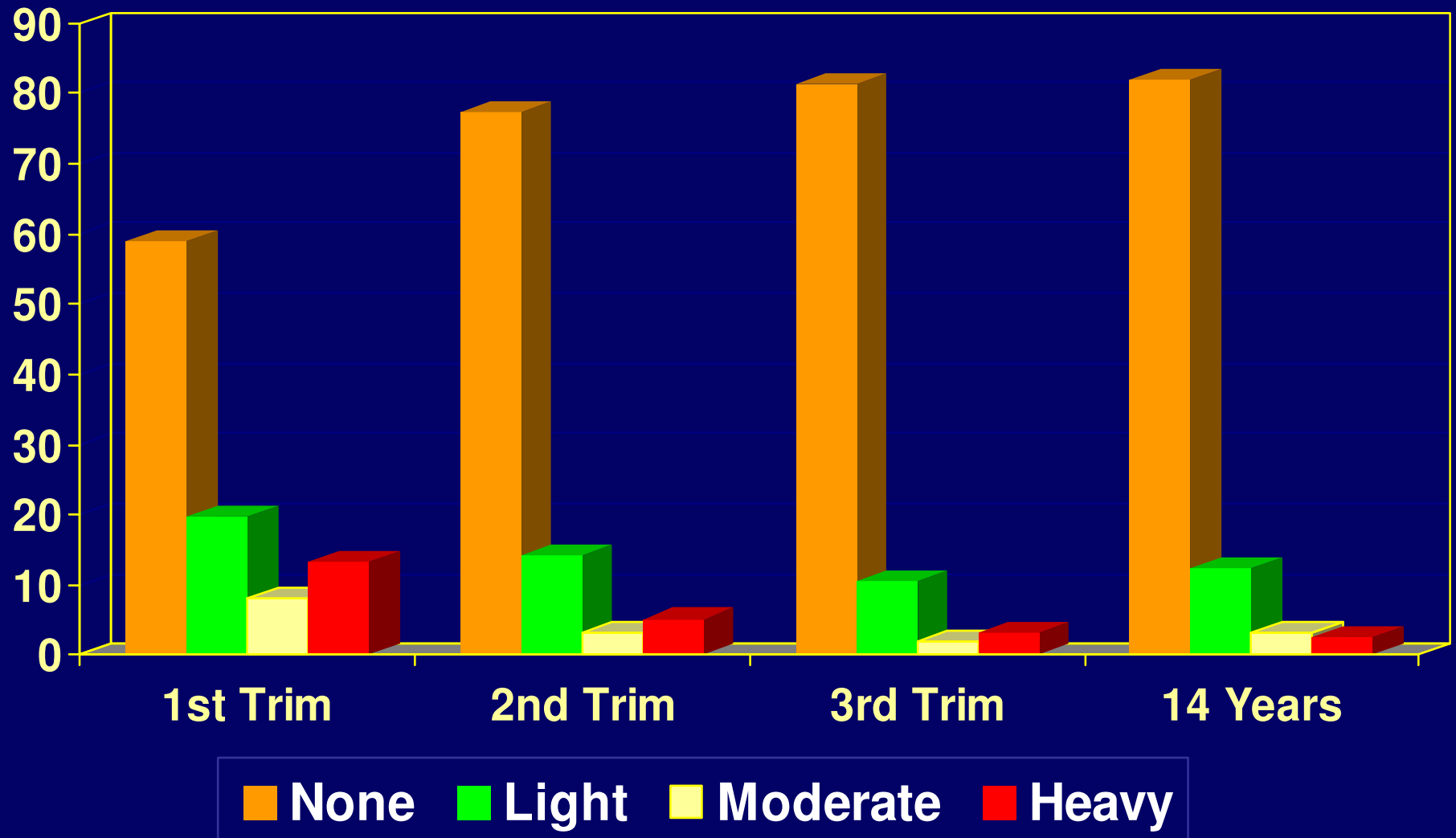
EARLY PREGNANCY: White, Single, Better educated, Employed

CONTINUED THROUGHOUT PREGNANCY:  
African-American, Other substance use,

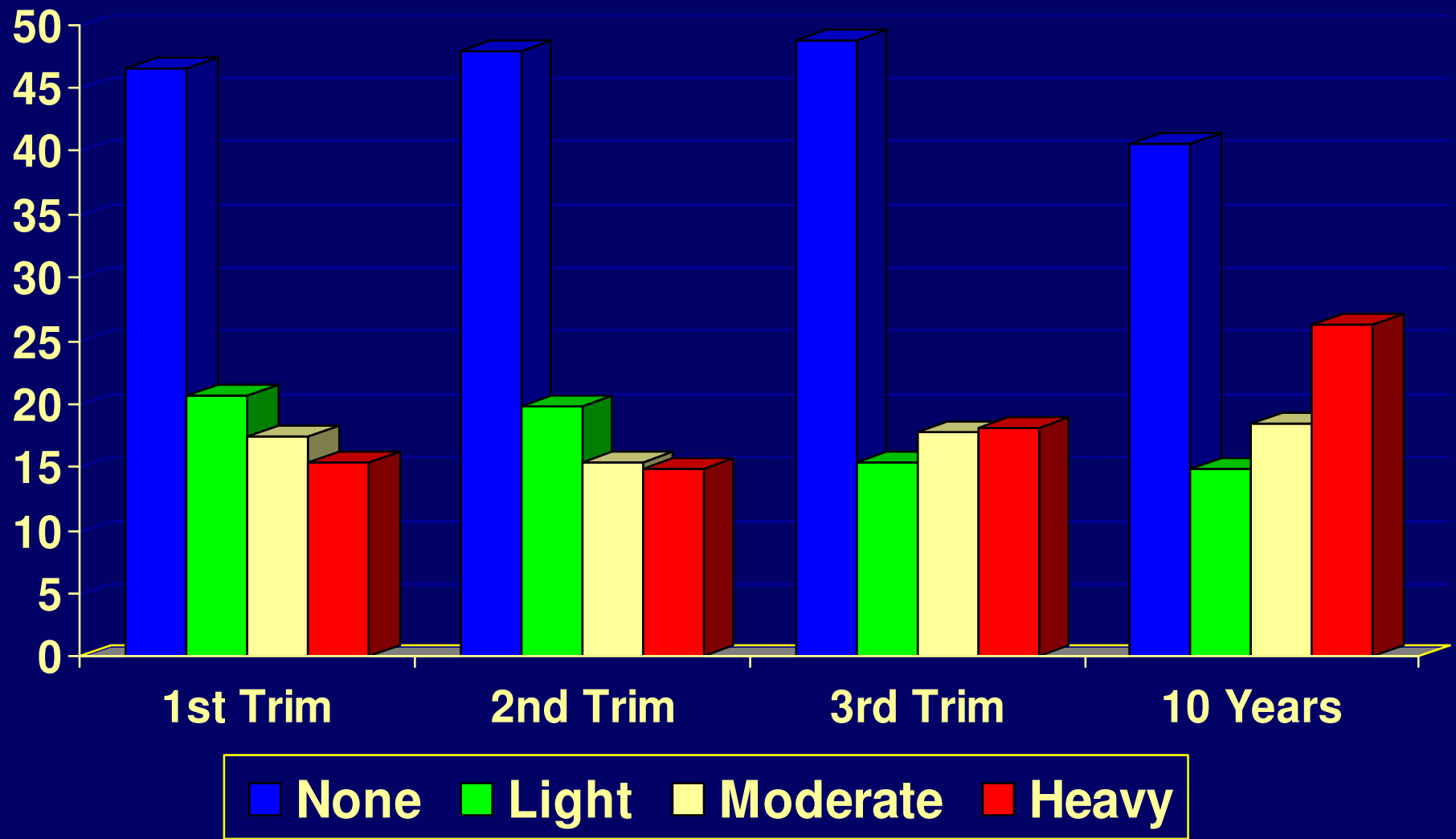
# PATTERN OF ALCOHOL USE



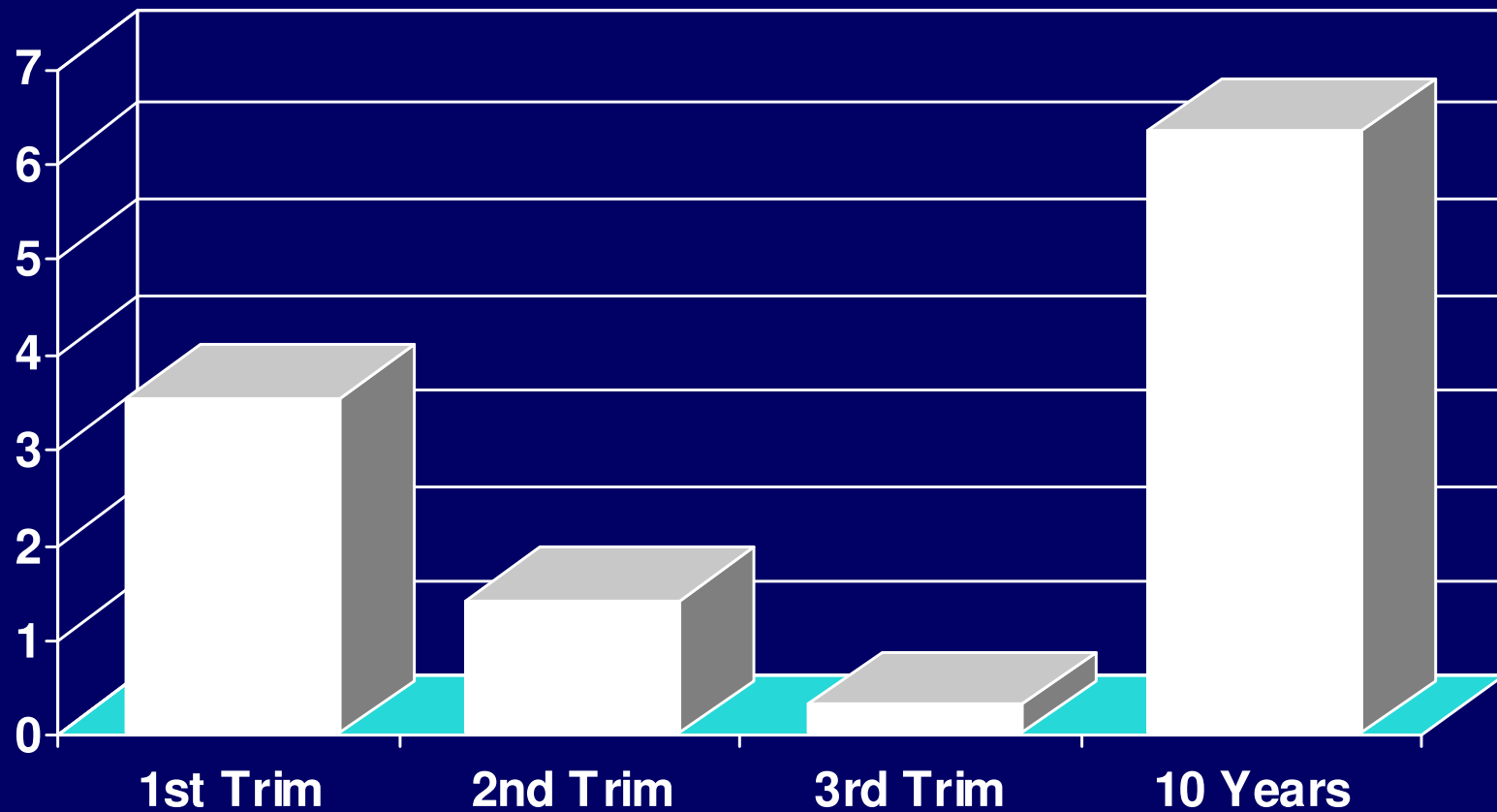
# PATTERN OF MARIJUANA USE



# PATTERN OF TOBACCO USE



# FREQUENCY OF COCAINE USE



# DIAGNOSTIC TERMS

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**FAS** FETAL ALCOHOL SYNDROME

**FAE** FETAL ALCOHOL EFFECTS

**FASD** FETAL ALCOHOL SPECTRUM  
DISORDER

**ARND** ALCOHOL-RELATED  
NEURODEVELOPMENTAL DISORDER

**ARBD** ALCOHOL-RELATED BIRTH  
DEFECTS

# DEFINITION OF FAS

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PRENATAL AND/OR POSTNATAL  
GROWTH DEFICIENCY  
CHARACTERISTIC MINOR FACIAL  
ANOMALIES  
EFFECTS ON THE STRUCTURE OR  
FUNCTIONING OF THE CENTRAL  
NERVOUS SYSTEM



# DEFINITION OF GROWTH DEFICITS

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BELOW THE 10<sup>TH</sup> PERCENTILE IN  
WEIGHT AND/OR LENGTH ADJUSTING  
FOR GESTATIONAL AGE.

# FACIAL FEATURES

SHORT PALPEBRAL FISSURES

ELONGATED MIDFASE

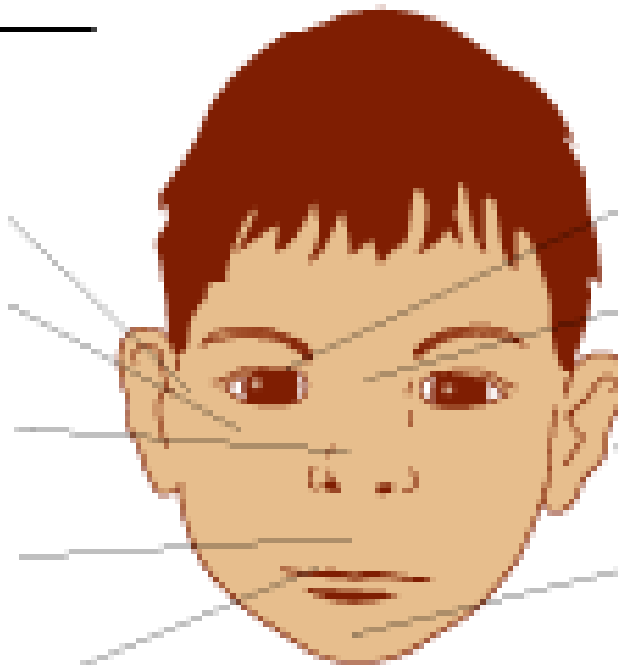
LONG AND FLATTENED PHILTRUM

THIN UPPER LIP

FLATTENED JAW

## **Discriminating Features**

Short palpebral  
fissures  
Flat midface  
Short nose  
Indistinct philtrum  
Thin upper lip



## **Associated Features**

Epicanthal folds  
Low nasal bridge  
Minor ear anomalies  
Micrognathia

# DEFINITION OF CNS INVOLVEMENT

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NEUROLOGIC ABNORMALITIES

DEVELOPMENTAL DELAYS

BEHAVIORAL BEHAVIORS

COGNITIVE DEFICITS

DEFICITS IN HEAD SIZE

CHANGES IN THE BRAIN ON IMAGING.

## **FAE AND FASD**

**DESCRIBE PEOPLE WHO HAVE SOME OF THE FEATURES OF FAS, BUT WHO DO NOT HAVE ENOUGH FEATURES TO MEET THE DIAGNOSTIC CRITERIA.**

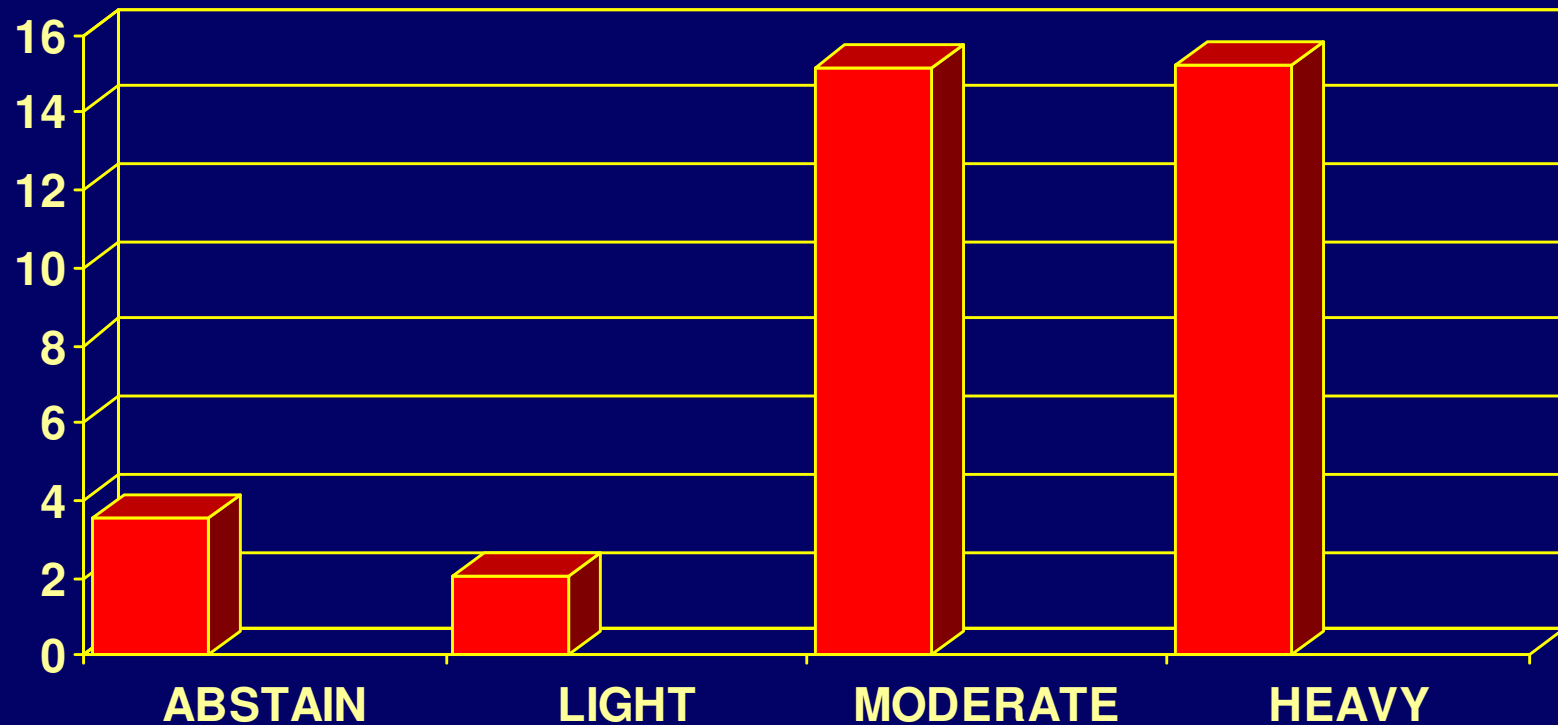
## **ARND AND ARBD**

**DESCRIBE SUBSETS OF THE SYMPTOMS OF FAS GROUPED BY BIOLOGICAL SYSTEMS**

# **PREDICTIVE VALUE OF HEAD CIRCUMFERENCE <10<sup>TH</sup> PERCENTILE AND ONE MORPHOLOGICAL ANOMALY**

	<b>AFFECTED</b>	<b>OTHERS</b>
<b>IQ</b>	<b>85.5</b>	<b>95.9</b>
<b>MATH (WRAT-R)</b>	<b>80.0</b>	<b>03.3</b>
<b>SPELLING</b>	<b>79.0</b>	<b>89.2</b>
<b>READING</b>	<b>89.2</b>	<b>93.9</b>
<b>AVERAGE DAILY VOLUME – 1<sup>ST</sup> TRIM</b>	<b>1.37</b>	<b>0.57</b>
<b>AVERAGE DAILY VOLUME – 3<sup>RD</sup> TRIM</b>	<b>1.28</b>	<b>0.10</b>

**PERCENT OF OFFSPRING WITH HEAD  
CIRCUMFERENCE <10TH PERCENTILE AND ONE  
MORPHOLOGICAL ABNORMALITY BY THIRD  
TRIMESTER ALCOHOL EXPOSURE**



# **A BRIEF LESSON IN TERATOLOGY**

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**DEVELOPMENT DURING PREGNANCY IS  
SEQUENTIAL**

**EXPOSURE AT ANY GIVEN TIME WILL AFFECT THE  
SYSTEM/FUNCTION THAT IS DEVELOPING AT  
THAT TIME**

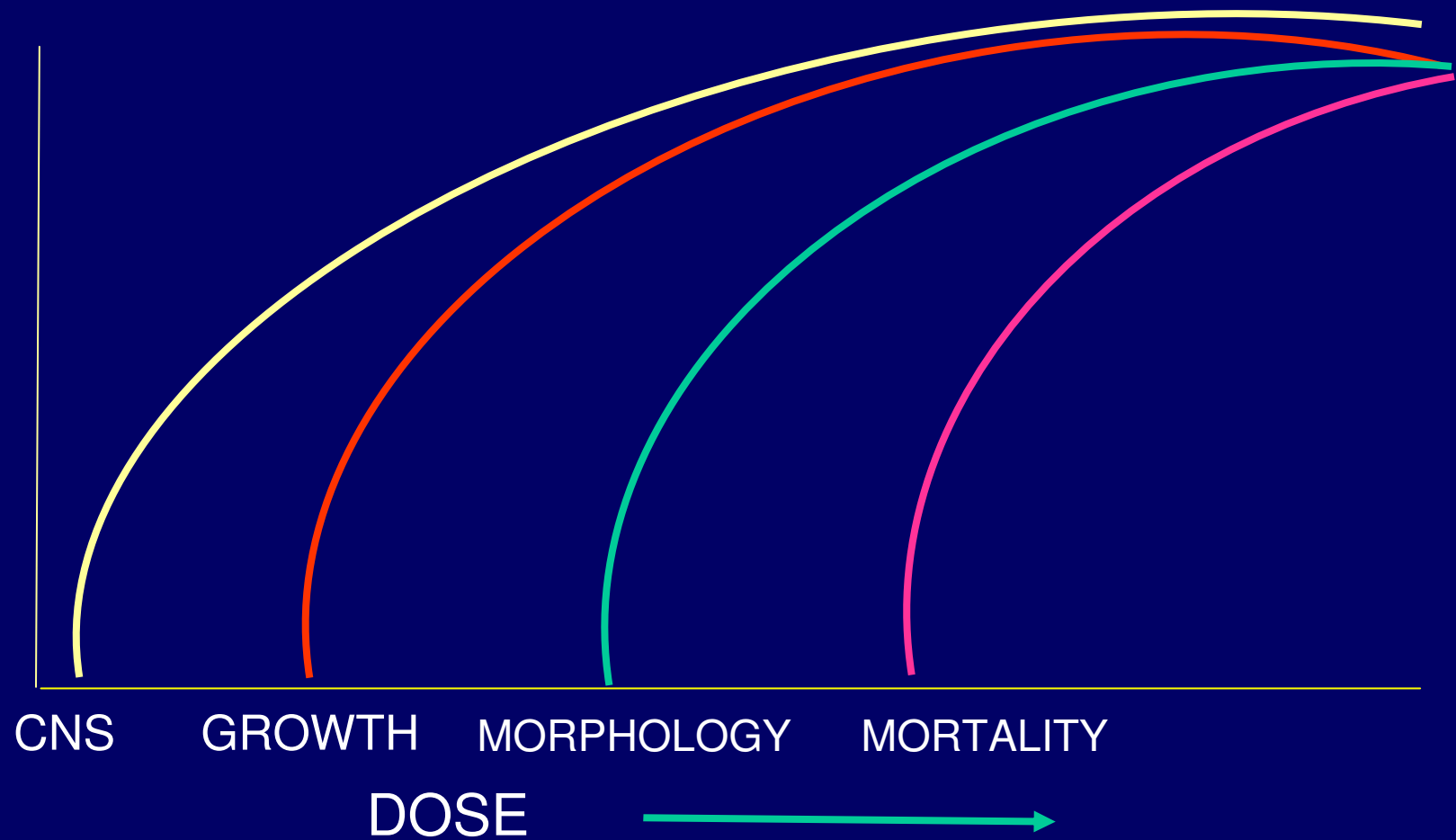
**THE EFFECT ON EACH DEVELOPING  
SYSTEM/FUNCTION IS RELATED TO THE DOSE  
OF THE EXPOSURE**

**LARGER EXPOSURES CAN LEAD TO EFFECTS ON  
MORE SYSTEMS/FUNCTIONS**

**EXPOSURE OVER A LONGER TIME WILL LEAD TO  
EFFECTS ON MORE SYSTEMS/FUNCTIONS**

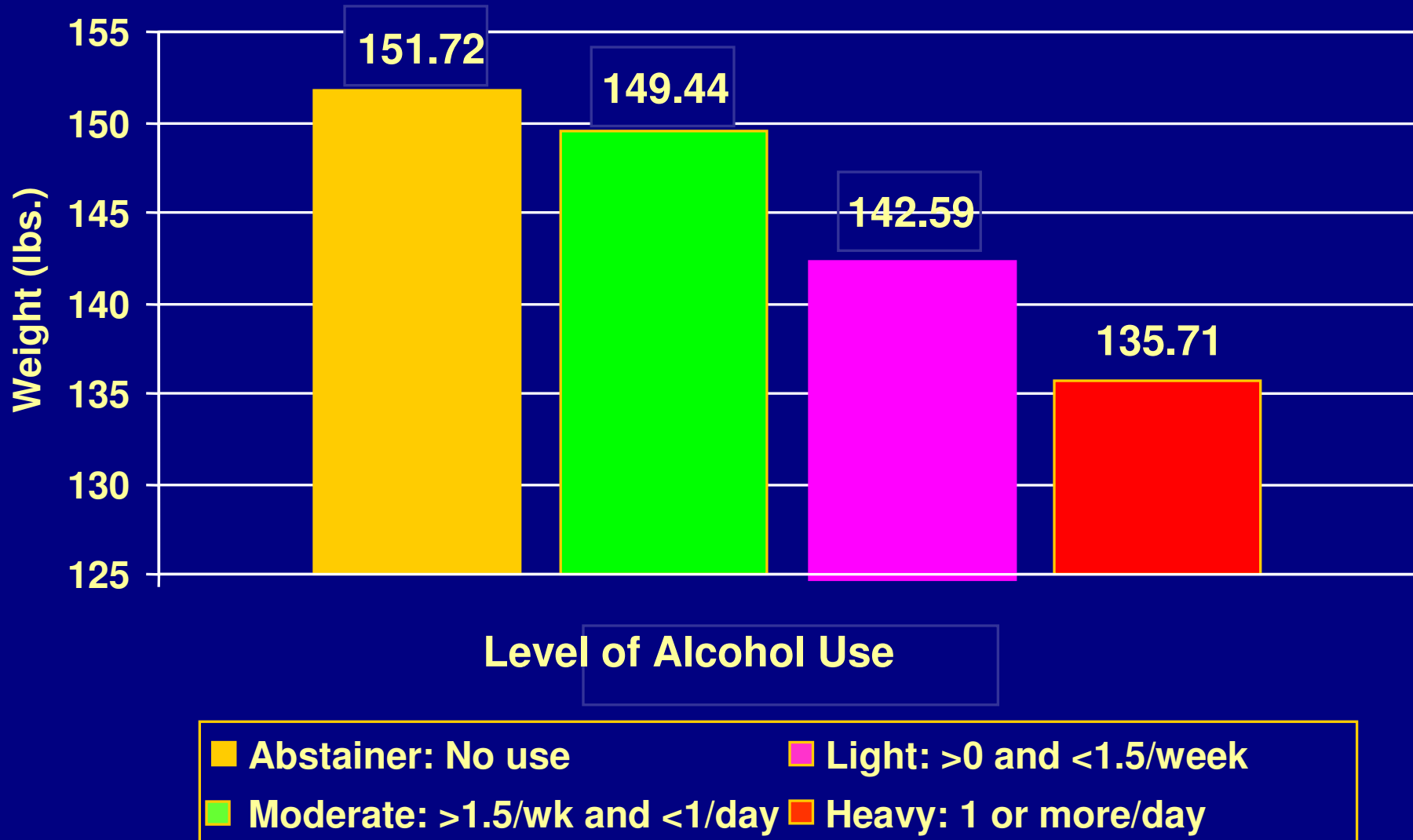


# TERATOLOGIC MODEL

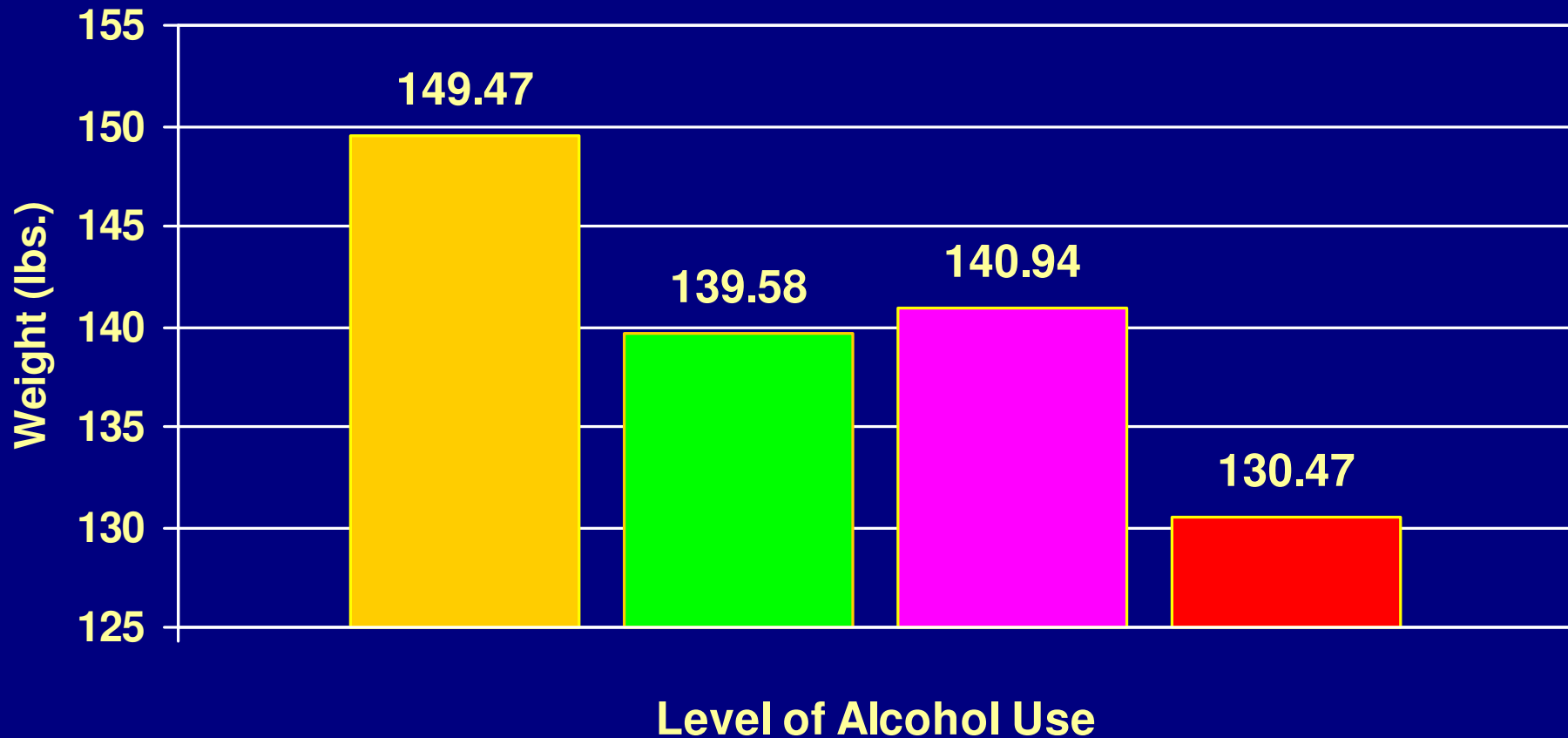


GROWTH

## OFFSPRING WEIGHT BY FIRST TRIMESTER ALCOHOL EXPOSURE

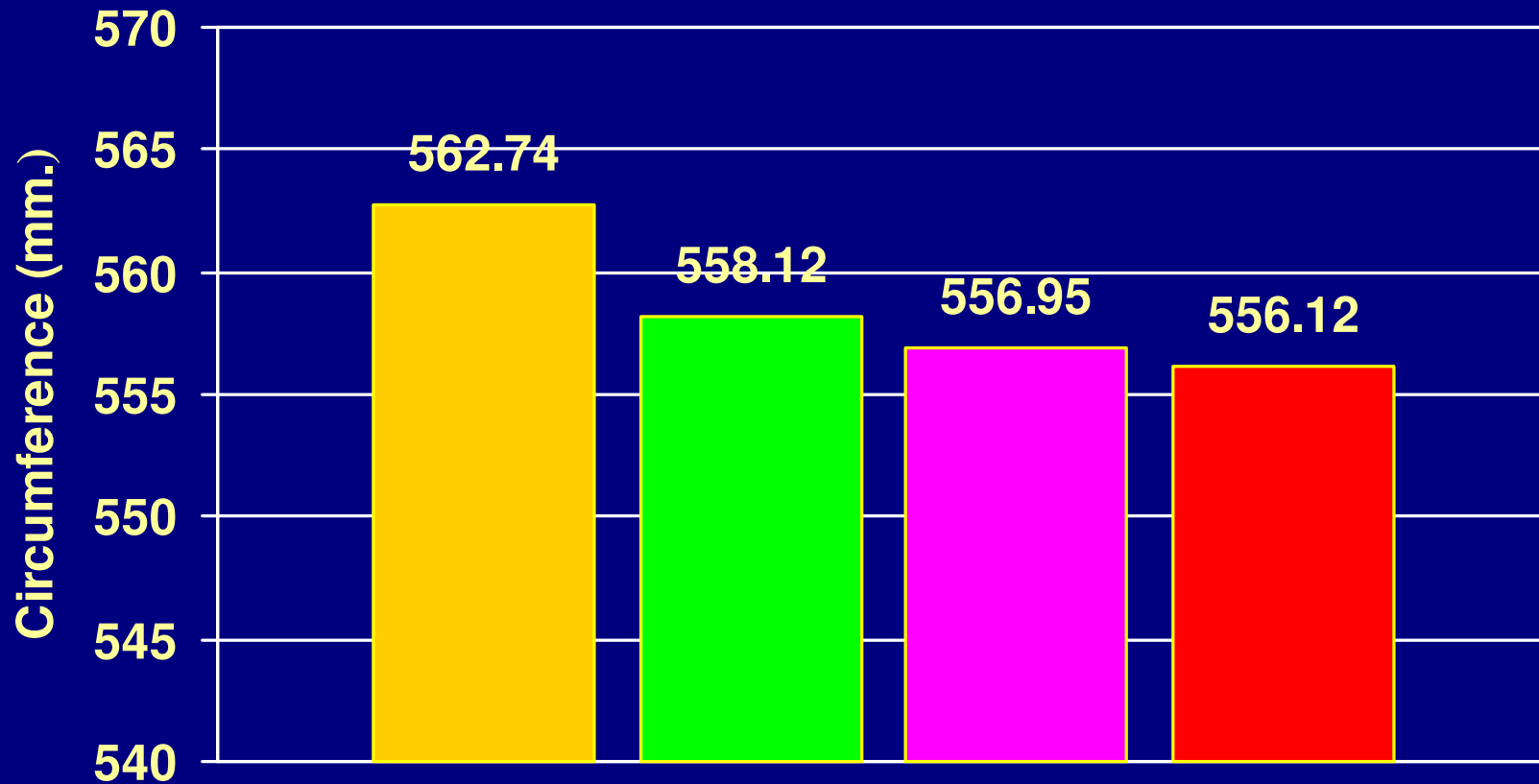


## OFFSPRING WEIGHT BY SECOND TRIMESTER ALCOHOL EXPOSURE



■ Abstainer: No use      ■ Light: >0 and <1.5 drinks/week  
■ Moderate: >1.5/wk and <1/day      ■ Heavy: 1 or more/day

## OFFSPRING HEAD CIRCUMFERENCE BY SECOND TRIMESTER EXPOSURE



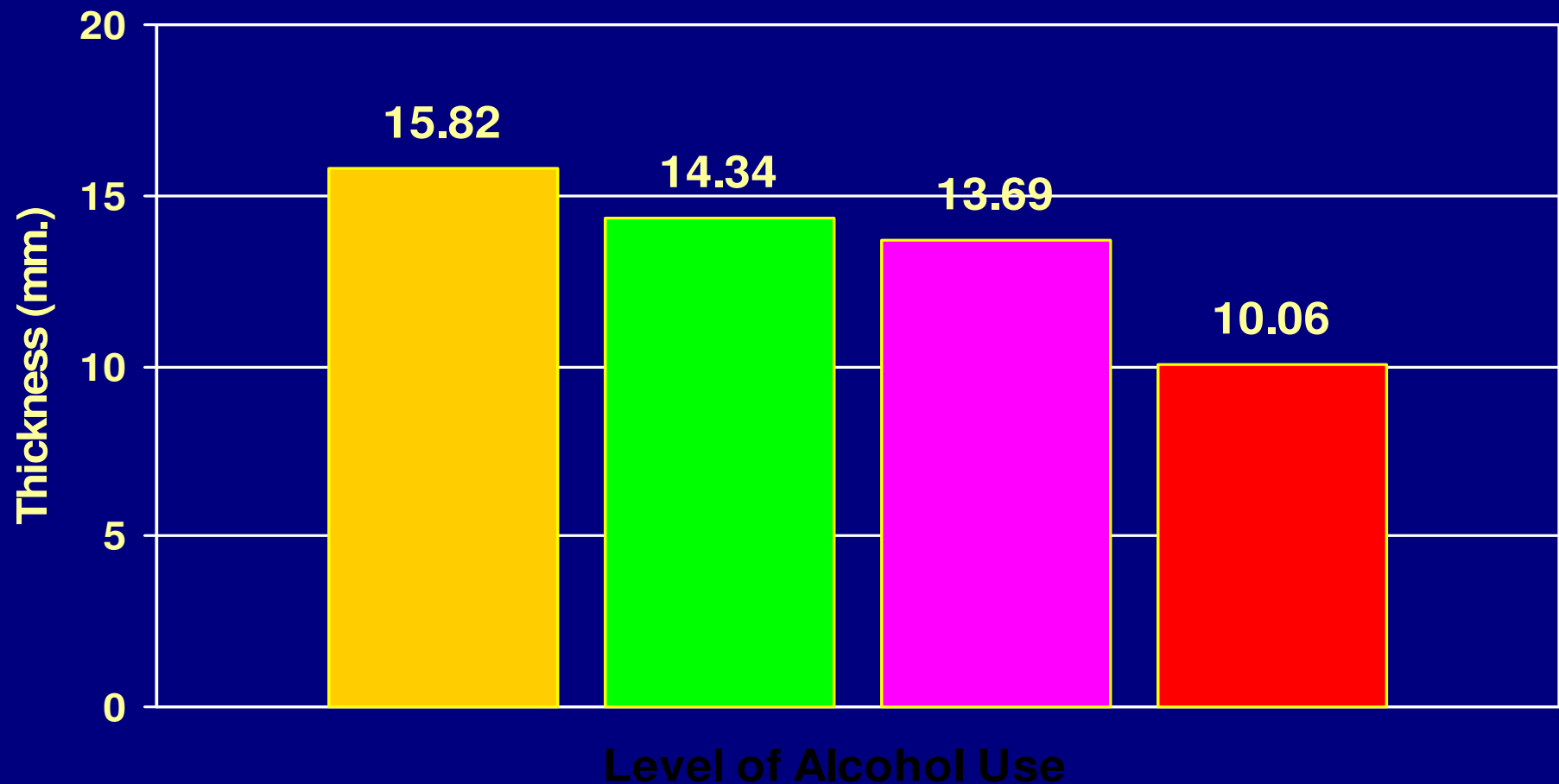
■ Abstainer: No use

■ Light: >0 and <1.5 drinks/week

■ Moderate: >1.5 drinks/wk and <1/day

■ Heavy: 1 or more/day

## OFFSPRING SKINFOLD THICKNESS BY SECOND TRIMESTER ALCOHOL EXPOSURE



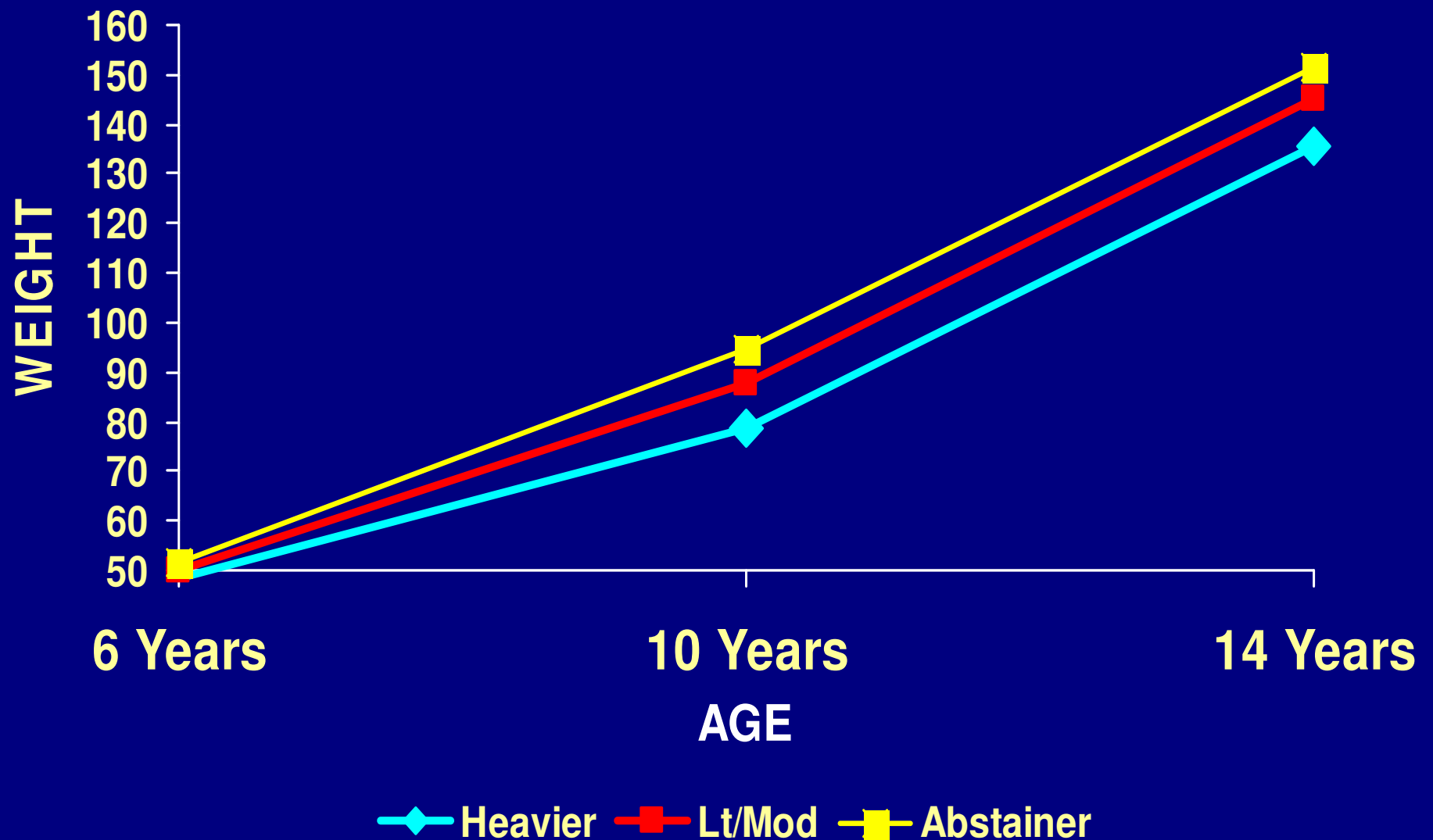
■ Abstainer: No use

■ Light: >0 and <1.5 drinks/week

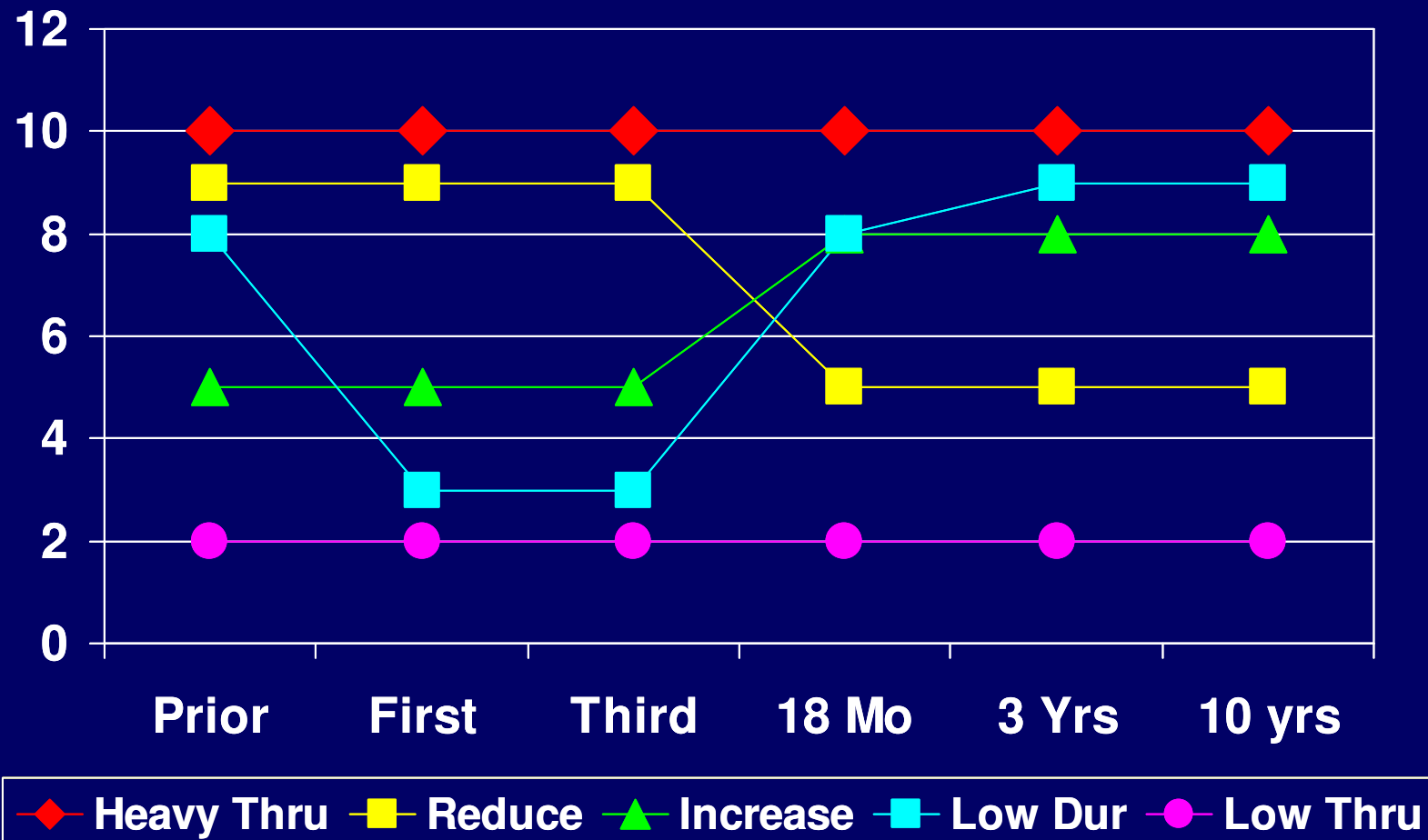
■ Moderate: >1.5 drinks/wk and <1/day

■ Heavy: 1 or more/day

## ADJUSTED MEAN WEIGHTS SECOND TRIMESTER EXPOSURE

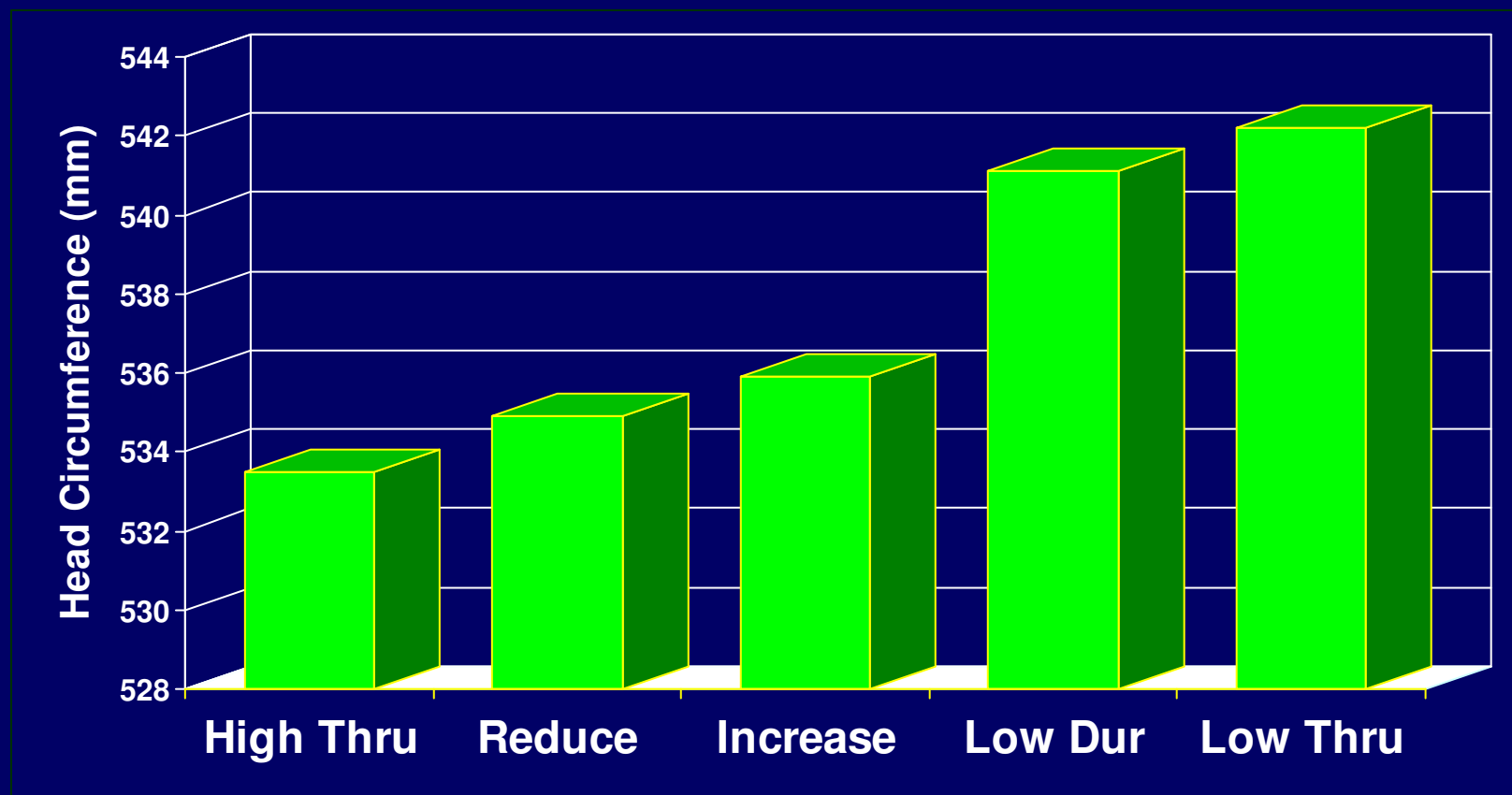


# Patterns of Maternal Substance Use Across Time





# Head Circumference at 10 Years by Maternal Alcohol Use Across Time

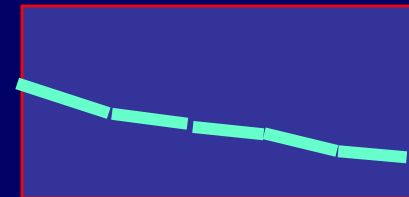


F  
A  
S

**GROWTH  $<$  10<sup>th</sup> PERCENTILE FOR  
LENGTH, WEIGHT, OR HEAD  
CIRCUMFERENCE**

M  
H  
P  
C  
D

 **GROWTH IN LENGTH, WEIGHT,  
HEAD CIRCUMFERENCE THROUGH  
AGE 10, LINEAR RELATION  
BETWEEN EXPOSURE  
AND SIZE**



F  
A  
S

**CHARACTERISTIC FACIAL  
FEATURES THAT DEFINE FAS**

M  
H  
P  
C  
D

 **NUMBER OF MINOR  
MORPHOLOGICAL MALFORMATIONS,  
INCLUDING THE FACIAL FEATURES  
OF FAS**

EFFECTS ON THE BRAIN

# **EFFECTS OF GESTATIONAL ALCOHOL EXPOSURE ON THE BRAIN**

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**IMAGING STUDIES**

**SMALLER BRAIN VOLUME**

**ABNORMALITIES IN SHAPE**

**ASYMMETRY**

**INCREASED GRAY MATTER DENSITY**

**DECREASED WHITE MATTER DENSITY**

**(SOWELL ET AL., 2001, 2002)**

# **BRAIN AREAS AFFECTED**

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**DORSAL FRONTAL CORTEX**

**ORBITAL REGIONS**

**[FUNCTIONS: EXECUTIVE FUNCTIONING, ATTENTION,  
BEHAVIORAL CONTROL]**

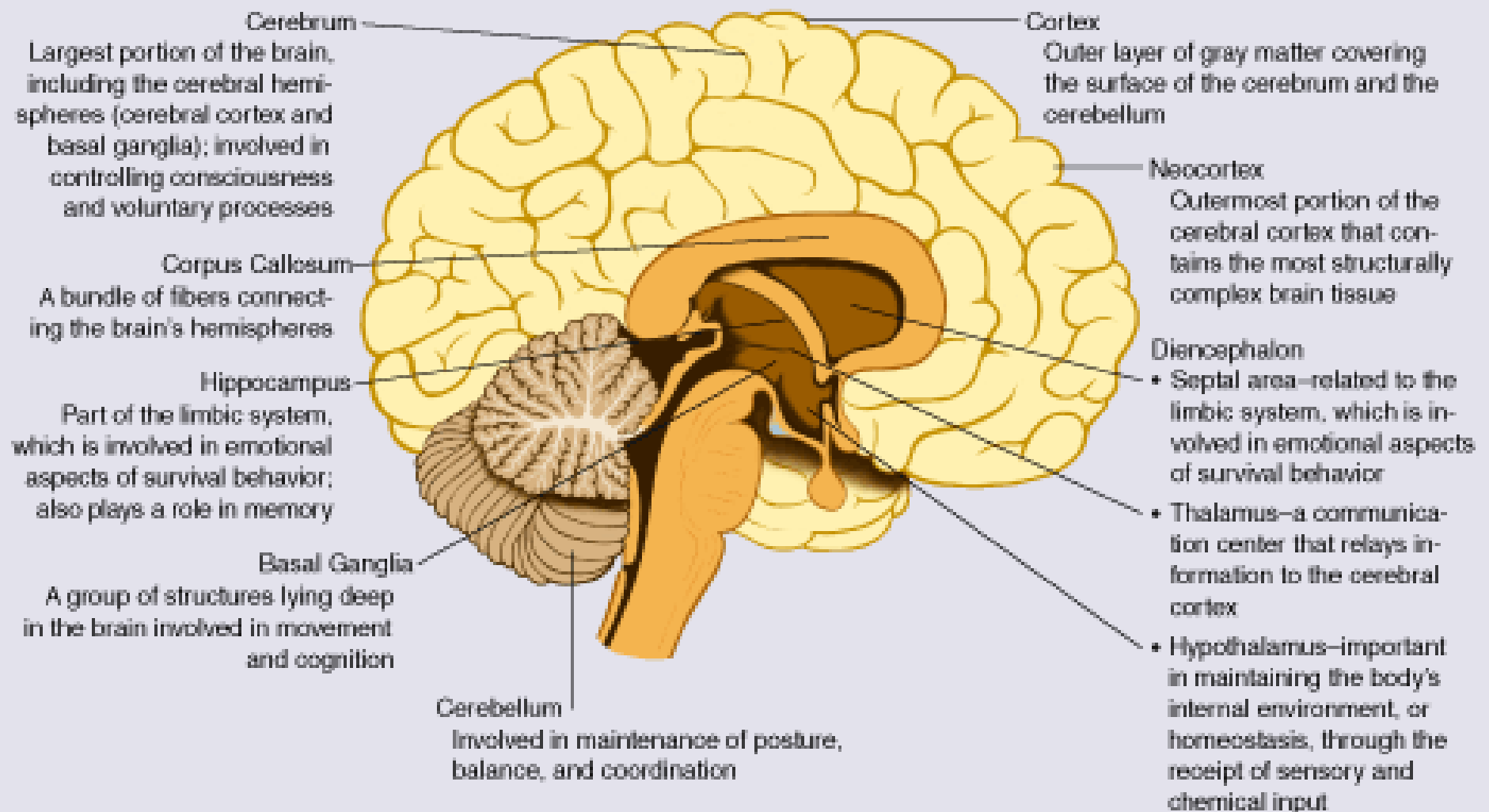
**BASAL GANGLIA**

**CORPUS CALLOSUM**

**CEREBELLUM**

**[FUNCTIONS: COGNITION, MOVEMENT, TIMING]**

**Sowell et al., 2001, Mattson et al., 1996, Riley 1995**



# DEFICITS IN EXECUTIVE FUNCTION AT AGE 14 PREDICTED BY PRENATAL ALCOHOL USE BY TRIMESTER (WISC-III)

EF Test	1 <sup>ST</sup> TRIMESTER	2 <sup>ND</sup> TRIMESTER	3 <sup>RD</sup> TRIMESTER
TRAIL MAKING	ALCOHOL		
CCT	ALCOHOL		
MAZES	ALCOHOL		
Block DESIGN			ALCOHOL
CODING			
PICTURE ARRANGEMENT			



# NEUROPSYCHOLOGICAL EFFECTS: Memory and Learning **Age 10**

Wide Range Assessment of Memory and  
Learning (WRAML):



Screening Test : Age 10



Story



Verbal



Design

# **Learning and Memory at Age 14**

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## **Children's Memory Scale**

### **Learning**

**Global Deficits**

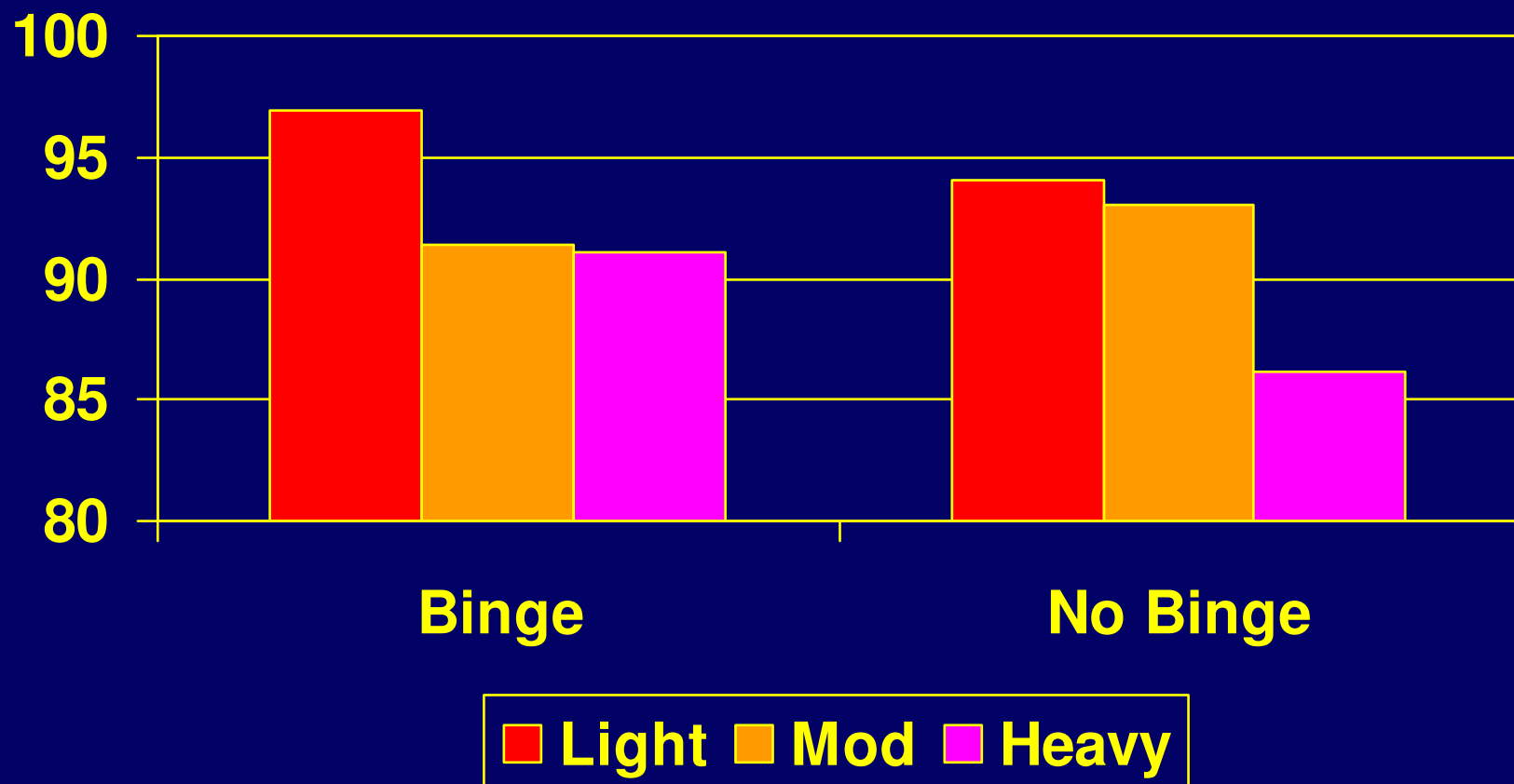
**Auditory/Verbal**

### **Memory**

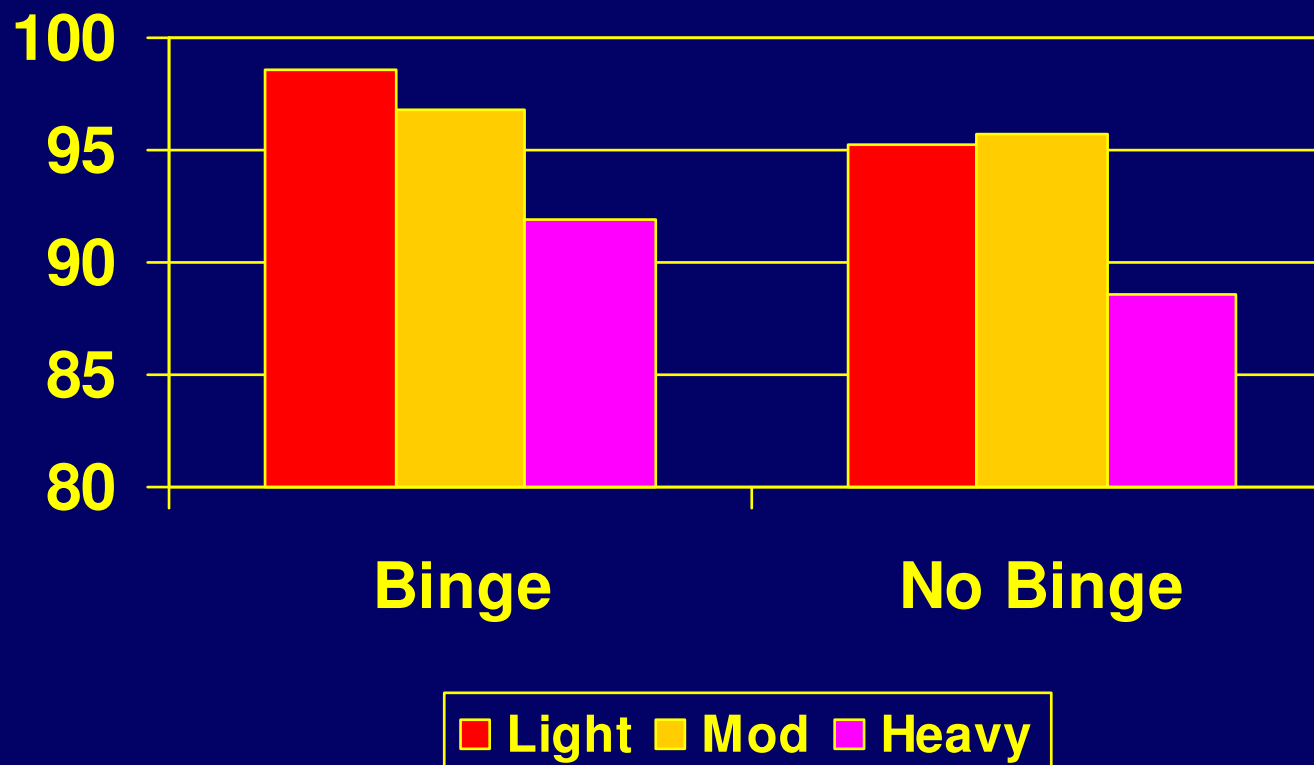
**Global Deficits**

**Auditory/Verbal**

## GENERAL MEMORY SCORES OF OFFSPRING OF BINGE AND NON-BINGE DRINKERS



## VERBAL DELAYED INDEX SCORES AMONG OFFSPRING OF BINGE AND NON-BINGE DRINKERS DURING PREGNANCY



# Neuropsychological Effects

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## Continuous Performance Test

Age 14



Errors of Omission

# MOOD AT AGES 6 AND 10

**Child Report (RCMAS)**



**Anxiety**

**Mother's Report (CBCL)**



**Anxiety**

**Teacher's Report (TRF)**

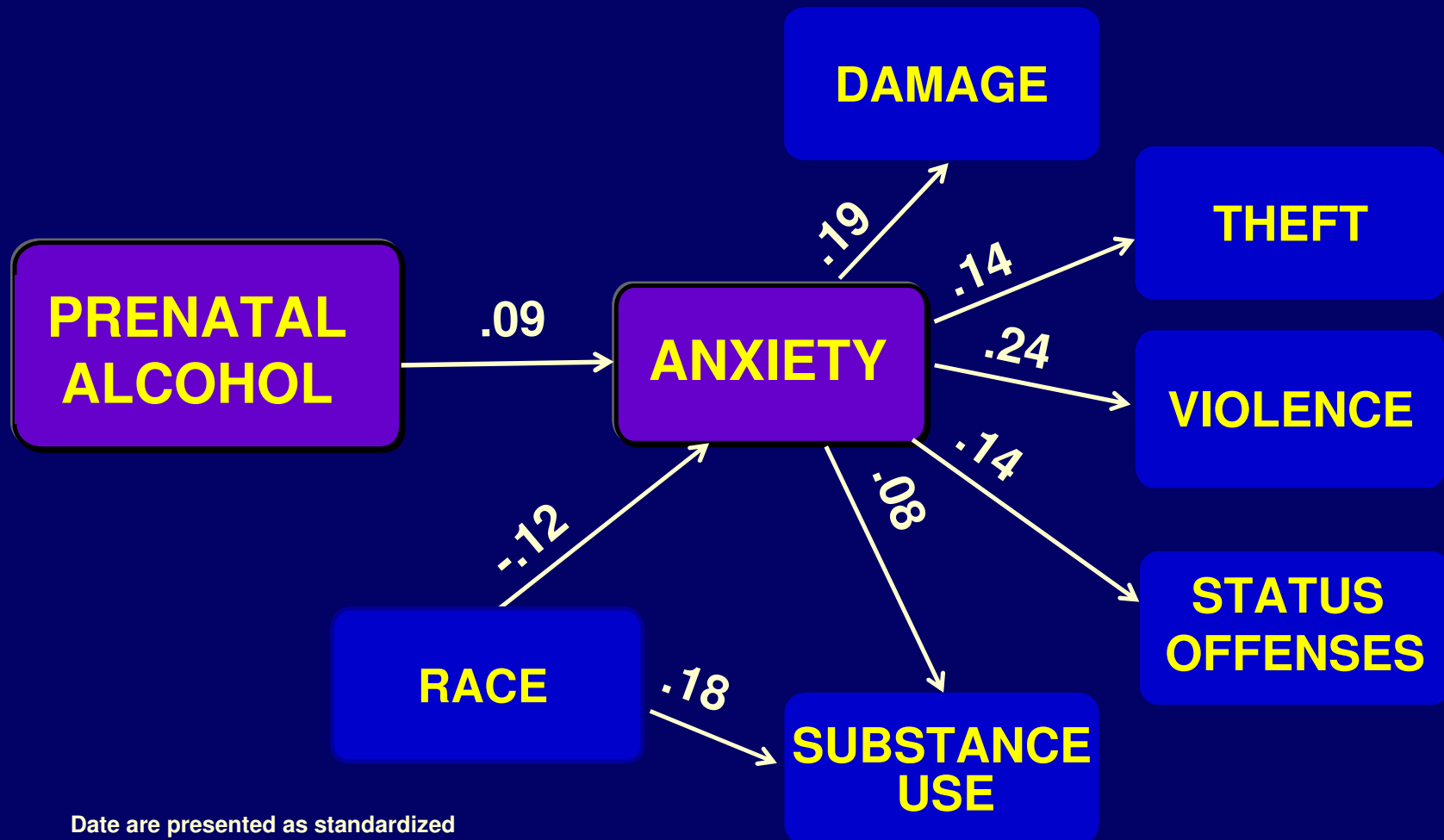


**Anxiety**

# PSYCHIATRIC STATUS AT AGE 16 AS MEASURED BY THE DIAGNOSTIC INTERVIEW SCHEDULE

- PRENATAL ALCOHOL EXPOSURE  
SIGNIFICANTLY PREDICTED:
- CONDUCT DISORDER
- MAJOR DEPRESSIVE DISORDER
- NOT ALCOHOL USE DISORDER

# ANXIETY MEDIATES THE EFFECTS OF PRENATAL ALCOHOL EXPOSURE AT AGE 10

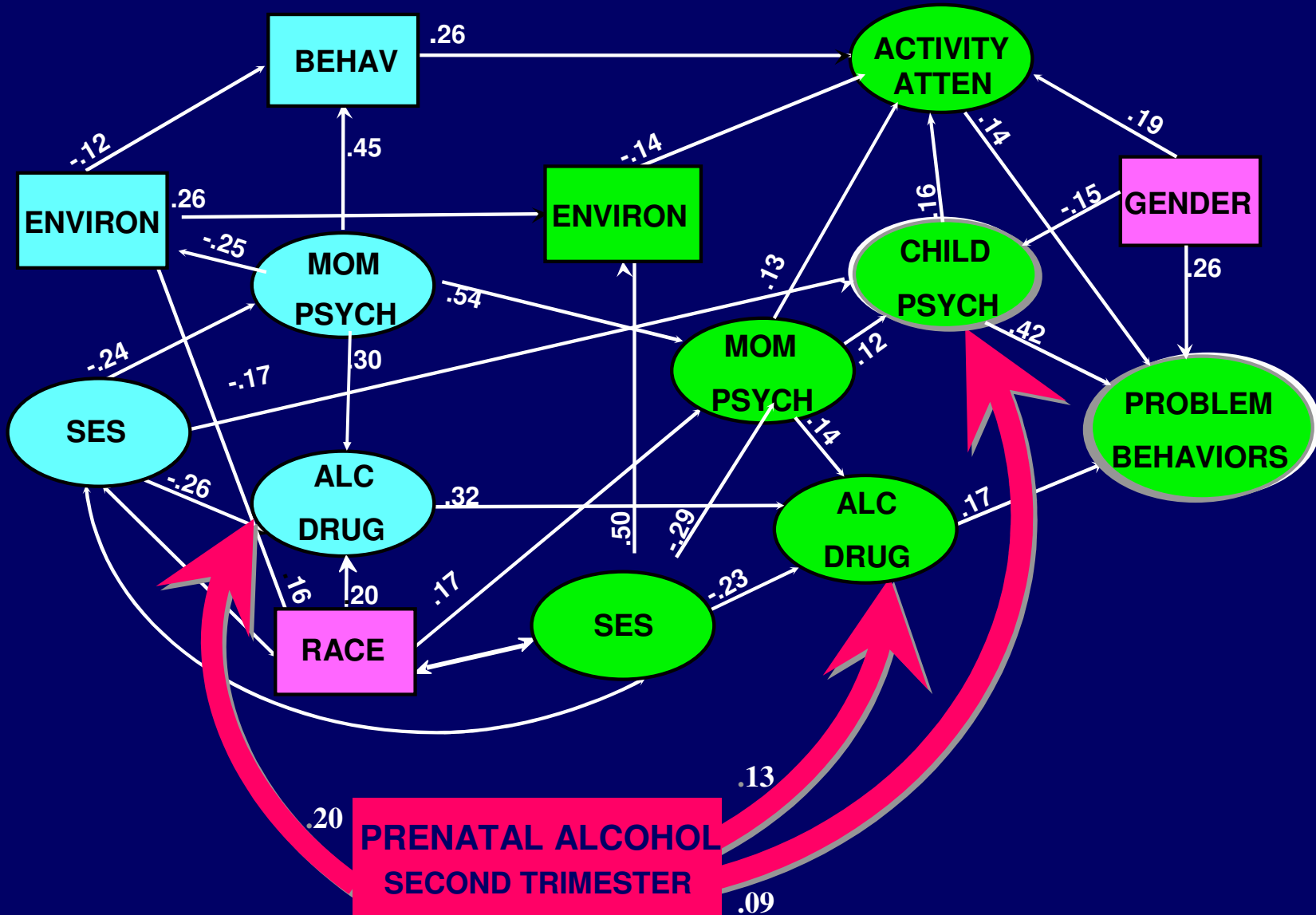


Data are presented as standardized coefficients.



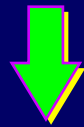
# AGE 3 YEARS

# AGE 10 YEARS

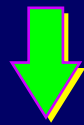


# TEMPERAMENT AT 3, 6, AND 10 YEARS

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**Emotionality**



**Shyness**

# COGNITIVE DEVELOPMENT AT **AGE 3** ON THE STANFORD-BINET

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**Short-Term Memory**

**Above 1.5 drinks/day**

# **COGNITIVE DEVELOPMENT AT AGE 6 ON THE STANFORD-BINET**

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**Composite**

**Short-Term Memory**

**Verbal Reasoning**

# COGNITIVE DEVELOPMENT AT **AGE 10** ON THE STANFORD-BINET

**Composite Score**

**Short-Term Memory**

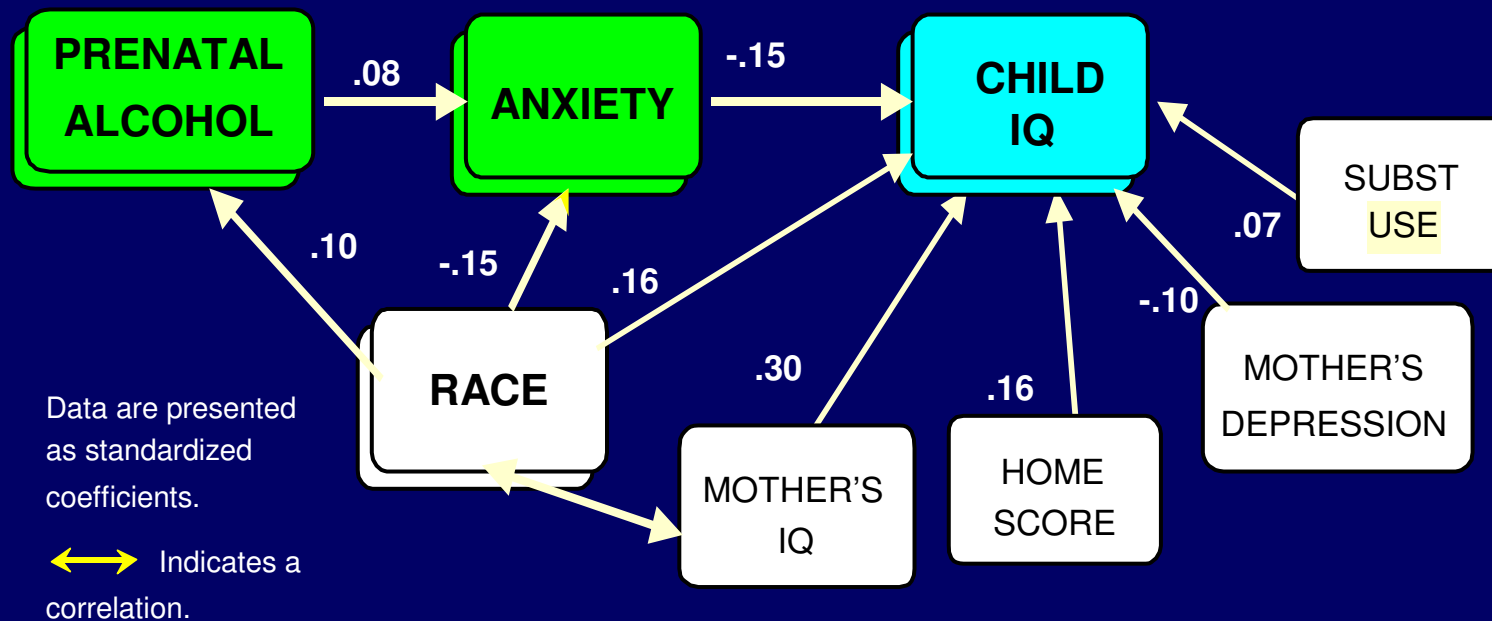
**Verbal Reasoning**

**Abstract/Visual Reasoning**

**Quantitative Reasoning**

**ONLY AMONG AFRICAN-AMERICANS**

# RELATIONS BETWEEN PRENATAL ALCOHOL EXPOSURE AND CHILD'S IQ SCORE AT AGE 10



- AT AGE 14, THERE WERE NO SIGNIFICANT ASSOCIATIONS BETWEEN PRENATAL ALCOHOL EXPOSURE AND COGNITIVE DEVELOPMENT AS MEASURED BY THE WISC-III

BEHAVIOR



# BEHAVIOR AT AGE 6

## Child Behavior Checklist and Teacher's Report Form

<u>CBCL</u>		<u>TRF</u>	
↑	Externalizing	↑	Externalizing
↑	Withdrawal	↑	Anxiety
↑	Delinquency	↑	Total

EFFECTS OF PRENATAL ALCOHOL  
EXPOSURE ON BEHAVIOR AT AGE 3  
MEASURED BY THE TODDLER  
BEHAVIOR CHECKLIST

**HIGHER RATE OF IMMATURITY**

# BEHAVIOR AT AGE 6

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**CBCL**

**Extrnalizing**

**Withdrawn**

**Delinquency**

**TRF**

**Total**

**Externalizing**

**Anxiety/Depression**

# BEHAVIOR AT AGE 10

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**CBCL**

**Total**

**Internalizing**

**Anxiety/Depression**

**Attention**

**TRF**

**Total**

**Externalizing**

**Anxiety/Depression**

# SCHOOL ACHIEVEMENT

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Reading, Spelling, Math (WRAT-R)

Age 6



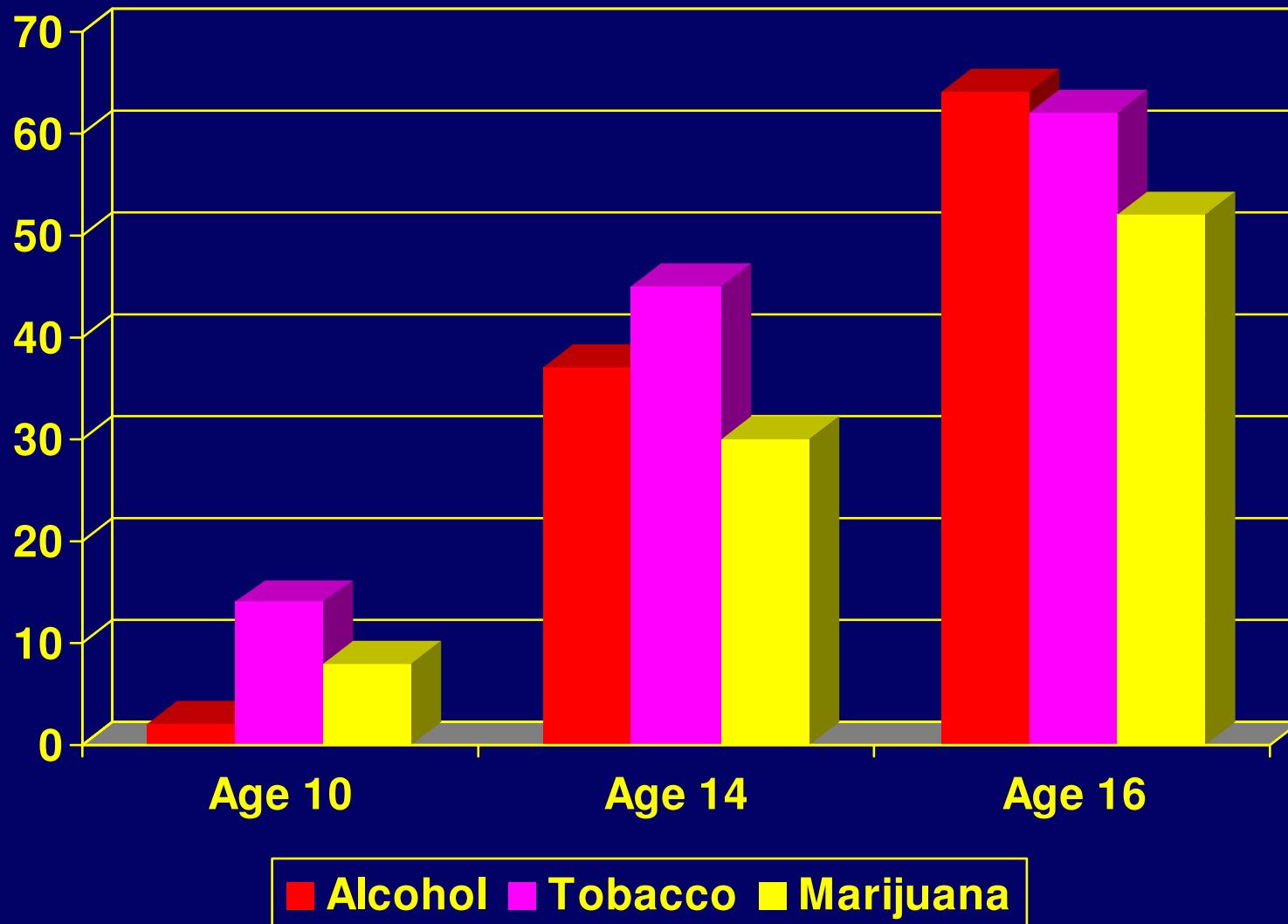
Reading Recognition (PIAT-R) Age 10



Reading Recognition (PIAT)

Math Achievement (WRAT-R): Age 14


# SUBSTANCE USE AMONG THE OFFSPRING



**F  
A  
S**

## **CENTRAL NERVOUS SYSTEM DEFICITS**

**M  
H  
P  
C  
D**

 **NUMBER OF NEUROLOGICAL  
CHANGES MANIFESTED AS  
NEUROPSYCHOLOGICAL DEFICITS,  
BEHAVIORAL PROBLEMS AND  
DECREASES IN PERFORMANCE**

# SUMMARY

## PRIMARY OUTCOMES

- Concept Formation
- Ability to Learn New Information
- Memory
- Attention
- Mood

## SECONDARY OUTCOMES

- Behavior Problems
- Academic Achievement